

Chapter 2: Plan for Achieving Comprehensive Assessments

In order to evaluate status and trends in water resources, USEPA has asked states to develop plans to comprehensively assess their waters. Comprehensive assessments should consider waterbody types (i.e., rivers, lakes, coastal waters, wetlands) and important parameters of concern. (USEPA, 1997). Assessment of wetlands is discussed in Part III, Chapter 6 and ground water is discussed in Part IV.

The spatial component of water assessments, particularly in rivers and streams, is technically challenging. Statistically sound methods to extrapolate data along rivers with variable hydrologic conditions (i.e., tributary confluences, natural and human induced flow variations) and variable watershed characteristics (slope, soils/ geology, patterns of land use and land cover) are not fully developed or are so complex that only very advanced statisticians can conduct the analysis. Analyses are also hindered by limited datasets (e.g., quarterly sampling for parameters that are influenced by season and flow).

Nationally, USEPA has advocated random sampling as the preferred approach to support statistical extrapolation of data to non-monitored streams. Ability to use classical statistical techniques to estimate population characteristics (e.g., median and range of DO in NJ streams) in randomly sampled stations is the major advantage of this approach. Also, randomly selected stations can be useful to identify previously unknown (emerging) issues. However, randomly selected stations do not provide information regarding the sources and causes of pollution and large numbers of stations are needed to evaluate highly variable systems. More importantly for water resources managers, randomly selected stations cannot be used to monitor problem areas or to evaluate the effectiveness of management measures. Thus a combination of randomly selected and targeted stations are needed to comprehensively assess and manage water quality.

Regression techniques that relate water quality to other variables (e.g., land use, basin size, and effluent flow) are another approach to provide comprehensive assessments that can indicate potential sources and causes of pollution.

2.1 Comprehensive Assessments of Rivers and Streams

As described below, NJDEP has several efforts underway and is working with USEPA's Consolidated Assessment and Listing Methodology workgroup to develop comprehensive assessments of New Jersey's rivers and streams.

Non-tidal rivers and streams are monitored for chemical and sanitary water quality, toxics in fish tissue, and for aquatic health. As discussed below, the aquatic health assessments conducted by NJDEP in the Ambient Biological Monitoring Network (AMNET) provide comprehensive spatial coverage and efforts are underway to improve the spatial extent of monitoring for chemical and sanitary water quality and toxics in fish tissue.

Comprehensive Assessments of Aquatic Health in Rivers and Streams

The Ambient Biological Monitoring Network (AMNET) has increased from 760 to 820 monitoring locations. At least 1 monitoring station is located in each of the state's freshwater watersheds (HUC11). The United States Geological Survey (USGS) compared various stream and watershed characteristics to the AMNET stations. (See Appendix 2.1-1).

This assessment was based on 780 AMNET sites being monitored at the time the assessment was conducted. Stream segments and AMNET sites were compared to a variety of watershed characteristics including drainage area, point source flow, population density, agricultural and urban land use. Similarities in distribution frequencies indicate that AMNET monitoring provides a representative, and thus spatially comprehensive, assessment of NJ non-tidal streams. In the future, NJDEP will be working to integrate other biological datasets (e.g., fisheries) to provide more comprehensive indicators of aquatic health.

Plan for Developing Comprehensive Assessments of Chemical and Sanitary Water Quality Monitoring in Non-tidal Rivers and Streams

This 2000 Water Quality Inventory Report relies on Ambient Stream Monitoring Network (ASMN) data collected between 1995 and 1997 by NJDEP and USGS at 81 sites. Based on USEPA Guidance, each monitoring station was assumed to represent 5 miles. This approach did not provide a comprehensive spatial assessment.

As discussed in Part III, Chapter 3, the ASMN was redesigned in 1997. The new design provides statistically-based comprehensive spatial assessment of freshwater, non-tidal streams. At the time this report was prepared only data from 1998 had been published by USGS, limiting the data available for assessment to four samples per station. Therefore, data from the redesigned ASMN will be used in subsequent Water Quality Inventory Reports.

The statistically based redesigned ASMN includes 5 station types and approximately 115 stations. The network includes 40 Statewide Status sites (2 per Watershed Management Area) that are randomly selected each year, using a computerized random number selection program, from the 820 AMNET sites. Thus, a significant component (35%) of network resources are dedicated to randomly sampled stations. Since Statewide Status sites are selected each year, confidence in the representativeness of this random network component will increase each year.

In addition, 40 Land Use Indicator stations are located to indicate water quality at the two dominant land uses in each WMA and 18 of 20 WMAs also have Watershed Integrator stations at the downstream end of the WMA. Note that Watershed Integrator stations could not be located in Cape May and Hackensack WMAs (WMAs 16 and 5, respectively) because these WMAs are primarily tidal.

NJDEP is conducting a project with a Regional Geographic Initiative Grant from USEPA Region II to evaluate the redesigned Ambient Stream Monitoring Network and develop a data analysis guidance manual. The project advisory committee includes representatives from NJDEP's Water Monitoring Management, Water Assessment Team, USEPA Region II's 305b Program and

Monitoring and Assessment Branch and USGS. With a statistician from Rutgers University, the project advisory committee is evaluating site selection criteria, site locations and the representativeness of the randomly selected statewide status stations. A data analysis guidance manual will be published that will include methods for estimating spatial representativeness in sampled waters and in similar waters without monitoring stations. Water quality - land use regressions are being considered.

NJDEP is establishing the Existing Water Quality (EWQ) network of 200 sites located at confluences and basin outlets. At least 1 monitoring site is expected to be located in each HUC11. EWQ will compliment the ongoing NJDEP-USGS Cooperative Ambient Stream Monitoring Network (ASMN) to monitor over 300 stations quarterly for 2 years in freshwater and tidal-freshwater rivers and streams.

The 303d Evaluation Monitoring Program includes stations in all waters included on the 1998 Impaired Waterbodies List (303d List) for metals and nutrients. Monitoring for metals is intended to evaluate current concentrations of metals using clean sampling and analytical techniques. Monitoring for nutrients is intended to evaluate the spatial extent of known exceedences of Surface Water Quality Standards numerical criteria. (N.J.A.C. 7:9B).

NJDEP is also working with USEPA on Comprehensive Assessment and Listing Methods (CALM) Workgroup. This USEPA effort is intended to provide states with additional guidance on assessment methods, including spatial extent of assessments.

2.2 Comprehensive Assessment of Lakes

NJDEP maintains that New Jersey's public lakes have been comprehensively assessed by the Clean Lakes Program and local health agencies responsible for assessing lake bathing beaches. The trophic status of about one-half of New Jersey's public lakes were assessed in the Clean Lakes Program and 123 of 126 of these assessed lakes were eutrophic. These data strongly suggest that the remaining public lakes are eutrophic. Note that many of New Jersey's public lakes are man-made impoundments on streams and are thus highly prone to eutrophication.

Local health agencies are responsible for assessing lake bathing beaches during the summer bathing season. These data provide a comprehensive assessment of lake bathing beach quality.

The status of New Jersey's reservoirs will be assessed through the Source Water Assessment Program. Some reservoirs are currently monitored by water purveyors or operating authorities but these data are not required under federal or state regulation to be collected or provided to NJDEP.

Currently, the NJDEP's Division of Fish and Wildlife collects dissolved oxygen (DO) data in New Jersey lakes. These data can be used to indicate the aquatic health of lakes since adequate DO is required for aquatic life. NJDEP and USEPA Region 2 are developing and testing a protocol for benthic assessment of lakes, which can compliment the DO assessments.

2.3 Comprehensive Assessment of Estuaries and Coastal Waters

New Jersey has achieved comprehensive assessment of estuaries and coastal waters through the 200 station water quality Marine and Estuarine Water Quality Monitoring Network, the Cooperative Coastal (Beach) Monitoring Program, the 4000 station National Shellfish Sanitation Program. The Marine and Estuarine Water Quality Monitoring Network includes stations in tidal rivers, estuaries and inlets which represent the variety of water quality conditions in New Jersey's coastal waters. The Cooperative Coastal (Beach) Monitoring Program includes weekly sampling of every protected ocean and bay bathing beach in New Jersey. The National Shellfish Sanitation Program has been approved by the Food and Drug Administration to ensure the safety of shellfish harvested in New Jersey.

Aquatic life assessments in these waters are based on DO measurements collected by NJDEP's Marine and Estuarine Water Quality Monitoring Network and USEPA's Helicopter Network. To compliment these assessments, NJDEP will begin implementation of benthic monitoring in estuaries upon completion of the protocol by USEPA Region 2.

2.4 Toxics in Biota

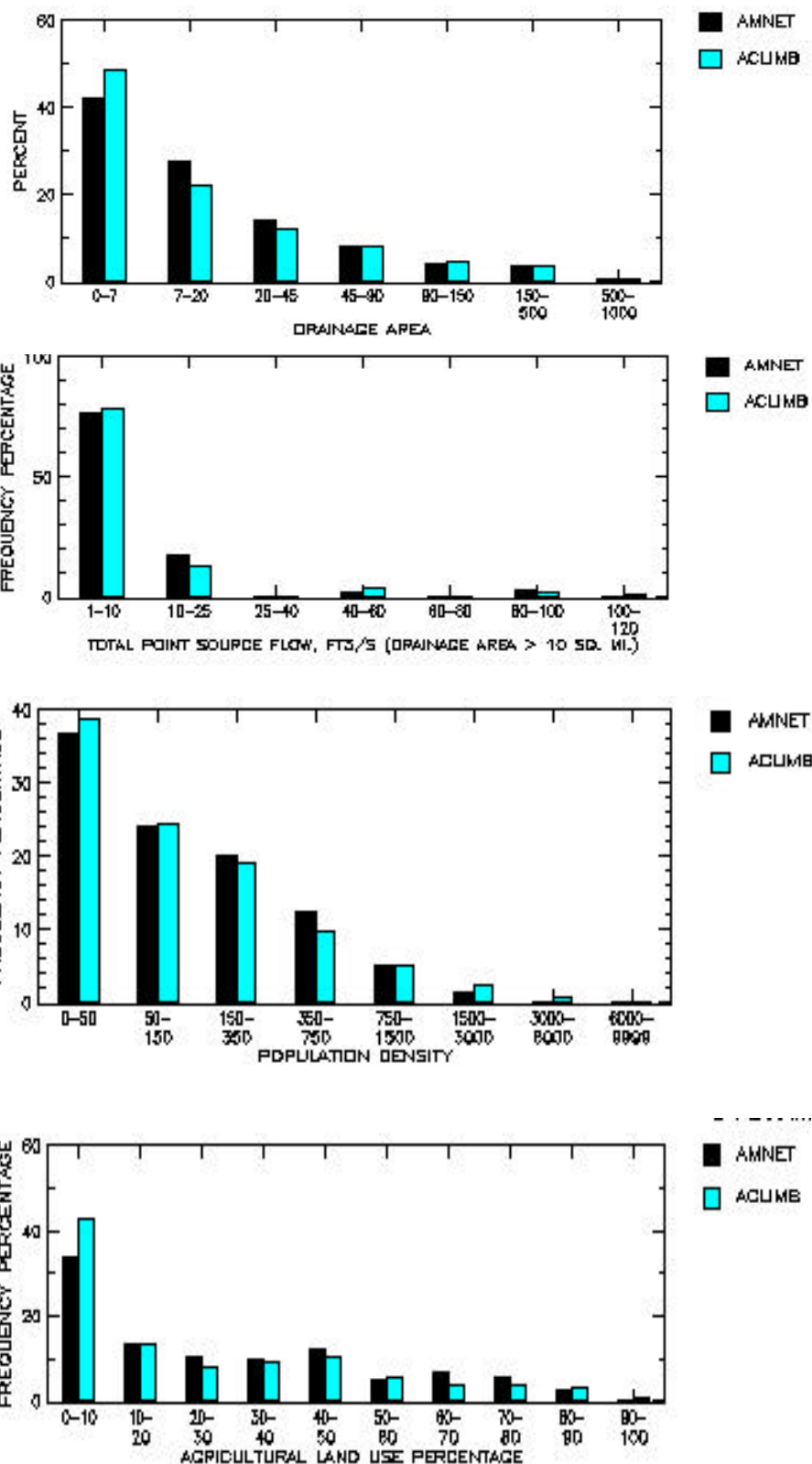
New Jersey has achieved significant progress toward comprehensive assessments of toxics in biota and has issued fish consumption advisories based on these data. However, many advisories are outdated and thus do not reflect current conditions. As discussed in Part II, Special State Concerns and Recommendations, a routine fish tissue monitoring program is recommended to support evaluation of older advisories and as appropriate, collection of data in waterbodies that are currently lacking data.

Appendix 2.1-1: Representativeness of NJDEP's AMNET Network

As part of the basis for the surface water-quality network re-design, the characteristics in the USGS ACLIMB GIS database of 7200 stream segments representing the entire population of the non-tidal streams in NJ were compared to the characteristics of the 780 NJDEP AMNET sampling sites. The figures to the right illustrate

that the AMNET sites are a nearly perfect sub-sample of the streams in NJ and clearly demonstrates that the AMNET design and site selection procedure does indeed represent the potential diversity of streams and, hence, the biological communities in NJ. It also provided a very strong support to use the 780 AMNET sites as the basis for selecting the water-quality sampling sites.

The decision to use the AMNET sites also added some very desirable operational overlap for the two programs. It provides water-quality and streamflow data to use with any future benthic invertebrate analyses of cause and effect and allow a more realistic comparison of the role of chemistry and flows (or their changes) on the health of NJ's biological communities. Since the sites were already thoroughly checked out while sampling for the invertebrates, it helped to minimize reconnaissance of the chemical sampling sites. It also helps to minimize the number of potential



sites to include in the 40-site random sample network design of the statewide status sites.

There was a concern that the redesigned Ambient Stream Monitoring Network (with 115 sites) would not be comprehensive enough to fully represent conditions in NJ. The design, however, actually considered this and a conscious effort was made to establish a basis

(sites) that could establish a statistically based approach to estimating the quality of stream reaches not sampled by the network. The 40 semi-randomly selected land-use indicator sites along with the 40 randomly selected statewide status sites could be used to evaluate non-monitored location and perhaps to develop regression models of various water-quality constituents and land-use or basin characteristics.

